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ABSTRACT

To investigate developmental differences, preschoolers' performance on four tasks frequently used to measure their understanding of causal and temporal relationships was studied. Based on an analysis of cognitive processes involved in recognition, completion, construction/seriation, and verbal explanation tasks, the prediction was made that children's temporal/causal understanding would emerge in the following order: recognition, completion, verbal explanation, and construction. Forty-eight preschool children between 3 and 5 years of age, representing a wide range of socioeconomic conditions, were tested in two sessions. All tasks involved three-picture temporal and causal sequences depicting events familiar to preschool children. Experimenters read sentences describing the pictured events aloud, thus removing the demand for children's perceptual encoding of contents. Sequences were presented one at a time. Findings show that preoperational children's ability to demonstrate temporal/causal understanding is significantly affected by the type of task presented and the mode of response required. Investigators found that 3-year-olds demonstrated moderate recognition skills, while 4-year-olds showed moderate completion skills and 5-year-olds exhibited the emergence of verbal explanation and seriation skills. It is concluded that children's ability to demonstrate causal/temporal understanding depends upon the task's demands for representational and mental manipulation skills. (RH)

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Preoperational Children's Temporal/Causal Understanding: Effect of Task

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Abstract

Recent investigations examining Piaget's contention that preoperational children are confused about causal/temporal relations have found mixed results. The present study examined the effect of task mode (recognition, completion, verbal explanation, seriation) on 3-5 year olds' demonstration of temporal/causal understanding. Findings show that three year olds demonstrate moderate recognition skills, four year olds moderate completion skills, and five year olds exhibit the emergence of verbal explanation and seriation skills. These results suggest that preoperational children's ability to demonstrate causal/temporal understanding depends upon the task's demand on representational and mental manipulation skills.

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Preoperational Children's Temporal/Causal Understanding:
Effect of Task

Kay Colby Sharp and Mindy Waxman

Piaget (1969) contends that prior to the acquisition of reversible operations, children are confused about temporal and causal relations. Recent investigators examining the validity of Piaget's claims, however, have found mixed results, (e.g., Brown and French, 1976; Bullock and Gelman, 1979; Cairns and Hsu, 1978; Kun, 1978; Sharp, 1982).

The research I'm presenting today explores a possible explanation for the discrepancies found in these studies. In particular, it focuses on the relationship between children's performance and the type of task used to measure their understanding of causal and temporal relations.

In examining the various tasks used in previous studies, it appears that they vary greatly in the cognitive processes required of the child for successful performance.

On recognition task, as used by Kun (1978) the child is presented a 3-picture series of events which are properly ordered temporally or causally and the child is required to point to the cause (the initial event) or the consequence (the terminal event) of the series in response to the experimenter's instructions. For example, she might state "Show me the picture that tells us why John fell down?" or "Show me the picture that tells us what Susan did after she took her bath." This task requires the child to understand the temporal/causal terms used in the questions and to demonstrate recognition of the temporal or causal order of events in the sequence. This task is highly structured for the child and seems to require little or no activation of mental manipulation skills.

A second type of task used in previous research is the completion task. This has been used by myself and Ann Brown and her colleagues. In this type of task the children are presented with one or two events of a 3-picture sequence of events and are required to find the missing picture among a number of distractors. The missing picture may be either the initial (cause) event or the terminal (consequence) of the sequence. Again, completion tasks require understanding of temporal/causal terms used in the instructions, as in the recognition task. Additionally, the child must be able to examine logically the events provided in relation to the events from which they must choose the picture which completes the series. Such logical searching would seem to demand visual scanning in addition to the ability to reason bidirectionally, that is, from either causes to consequences or backwards from consequences to causes, depending upon which picture is missing in the sequence. Completion tasks would, therefore, seem to require a more sophisticated set of skills than recognition tasks.

A third type of task is the construction task, similar to Piaget's seriation task. These types of tasks place even greater demands on the child's ability to mentally manipulate events. Here the child is given three pictures with no clue about the temporal or causal order of events and is required to actively construct logical order on their own. The child would seem to have to have the ability to run through the events systematically testing possible combinations until the most logical order is arrived at. This task would, therefore, seem to require a more robust development of logical operations than the recognition or completion tasks.

A fourth type of task, which I refer to as verbal explanation tasks, requires the child to verbally explain the temporal or causal relationship between events they have previously observed and to use temporal/causal terms such as "because," "after," "before" in their statements. For example, as in Cairns and Hsu, children were presented a series of pictures and later asked to tell me "when Christine went to school" or "why Charles got a spanking." While this type of task may require less mental manipulation skills than construction tasks, given the child is shown the correct sequence of events, the task demands greater ability to activate and manipulate a schema of events than completion tasks, as the stimuli are removed from the child's view before they are asked about the causal or temporal order of events. Further, this type of task places demands on the child's memory and linguistic skills.

Given the differences in cognitive processes demanded by the various tasks used previously in research on preoperational children's causal/temporal understanding, it is not surprising that findings have been mixed in terms of children's competency. It may be that these results, in fact, reflect a developmental progression in preschoolers' ability to demonstrate temporal/causal understanding.

The present study investigated this issue by examining preschoolers' performance across these four tasks to explore the developmental progress of their performance. Based on the above analysis of cognitive processes involved in each task, it was predicted that children's temporal/causal understanding would emerge in the order of recognition, completion, verbal explanation, and construction.

To test this hypothesis, 48 3-5 year olds, 16 children of each age, were tested. The children represented a wide range of socio-economic groups.

Children were tested on the four tasks as I previously described them in two sessions. All tasks involved three-picture temporal and causal sequences depicting events familiar to preschool children. The experimenter always reads sentences describing the events in the sequence, thus removing the demand for perceptual encoding of the contents (Sharp, 1982). Sequences were presented one at a time.

A 3 x 2 MANOVA (age group x order of presentation) revealed a significant age effect on performance ($p < .001$); order of presentation had no effect. Follow-up ANOVAs revealed a significant age effect on the completion task ($p < .001$), the verbal explanation task ($p < .001$) and the construction task ($p < .01$). There was no significant age effect on the recognition task. Newman-Keuls comparisons showed that 4 and 5 year olds completed a significantly greater proportion of sequences than 3 year olds (M = 77%, 81%, 68%, respectively). There was no significant difference between the 4 and 5 year olds' performance on the completion task.

Five year olds performed significantly better on the verbal explanation task than the 3 and 4 year olds (M correctly explained = 58%, 40%, 38%, respectively, $p < .01$). There was no difference in the 3 and 4 year olds' performance. Similar results were found on the construction tasks. Five year olds correctly constructed 52%, 4 year olds 29%, and 3 year olds 15% of the sequences (5 >3 year olds, $p < .01$; 5 <4 year olds, $p < .05$).

ANOVA within-age comparisons showed that performance was significantly affected by the type of task within each age group ($p < .001$). Newman-Keuls showed 3 year olds' scores followed the predicted pattern of recognition>completion>verbal explanation> construction. Four year olds showed no significant difference between the scores on recognition and completion or between their verbal explanation and construction scores. Their scores showed that performance on recognition and completion tasks was significantly better than performance on verbal explanation and construction. Similar results were found for 5 year olds.

Summing across the within and between-age results, the present study demonstrates that preoperational children's ability to demonstrate temporal/causal understanding is significantly affected by the type of task presented and mode of response required. As predicted, the youngest children show moderate recognition skills but have difficulty in demonstrating understanding on any of the other tasks. Four-year, as well as 5 year, olds continue to increase their recognition skills; however, the lack of significant differences in scores between 3 and 4 year olds, and 4 and 5 year olds suggests that recognition skills are intact by 3 years of age.

Four year olds demonstrate a significant increase in skills. Unlike the younger children, four year olds exhibit a moderate ability to scan and search for events that logically fit together on completion tasks. These findings also indicate the emergence of bidirectionality and support the notion that with the use of simple task contents and procedures, preschoolers can demonstrate bidirectional reasoning (Sharp, 1982).

Contrary to prediction, we did not witness the emergency of verbal explanation skills prior to construction. The pattern of within-age scores for both 4 and 5 year olds showed recognition and completion skills greater than verbal explanation and construction skills, with no significant difference between the latter two. Across-age comparisons show that 5 year olds are better in both these skills than the other two age groups; however, the absolute level of their verbal explanation and construction skills indicate less than moderate ability on these tasks. These results suggest that the ability to demonstrate skill on tasks involving more sophisticated representational and mental manipulation skills and/or linguistic and memory skills may be just emerging at 5 years.

A greater ability on verbal explanation tasks than on construction may become apparent at 6 years. Raw scores for 3-5 year olds show verbal explanation scores as consistently higher than construction scores (although not significantly so) and, thus, provide informal support for this hypothesis. However, investigation with older children is required to provide firm support.

The overall findings provide support for the existence of a developmental progression in temporal/causal understanding within 3-5 year olds prior to the acquisition of seriation, or construction, skills. These findings offer an explanation for the discrepant findings across previous investigations, which employed tasks that varied in the demand on children's cognitive processes for successful performance.

A major contribution of the present study was its usage of several types of tasks, each demanding a component skill, or a combination of skills, that may be required for demonstration of temporal/causal understanding on Piagetian seriation tasks. By examining children's

differing skill on each task, a greater understanding of the step-wise progression of within-stage development is acquired.

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